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ARTICLE

Habits of cell phone usage and sperm quality – does it warrant attention?

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Abstract Male infertility constitutes 30–40% of all infertility cases. Some studies have shown a continuous decline in semen quality since the beginning of the 20th century. One postulated contributing factor is radio frequency electromagnetic radiation emitted from cell phones. This study investigates an association between characteristics of cell phone usage and semen quality. Questionnaires accessing demographic data and characteristics of cell phone usage were completed by 106 men referred for semen analysis. Results were analysed according to WHO 2010 criteria. Talking for ≥1 h/day and during device charging were associated with higher rates of abnormal semen concentration (60.9% versus 35.7%, $P < 0.04$ and 66.7% versus 35.6%, $P < 0.02$, respectively). Among men who reported holding their phones ≤50 cm from the groin, a non-significantly higher rate of abnormal sperm concentration was found (47.1% versus 11.1%). Multivariate analysis revealed that talking while charging the device and smoking were risk factors for abnormal sperm concentration (OR = 4.13 [95% CI 1.28–13.3], $P < 0.018$ and OR = 3.04 [95% CI 1.14–8.13], $P < 0.027$, respectively). Our findings suggest that certain aspects of cell phone usage may bear adverse effects on sperm concentration. Investigation using large-scale studies is thus needed.

KEYWORDS: cell phone, male infertility, sperm concentration

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Introduction

The prevalence of infertility among couples of reproductive age, defined as a failure to conceive for 12 months, is 15% (Chandra et al., 2014). In 34% of the cases, the aetiology is related to male factor (Odisho et al., 2014). Semen quality has been reported to be declining during the last decades by some investigators (Lackner et al., 2005; Rolland et al., 2013), though not by others (Fisch, 2008). Trends observed over time and differences between reports may be due to demographic variations and to both behavioural and environmental factors, such as food composition and quality, smoking, stress, alcohol and drug consumption, global warming, air pollution, chemical toxins and radio frequency electromagnetic radiation (RF-EMR) (Erogul et al., 2006).

The use of cell phones has increased dramatically since their emergence about two decades ago. Throughout the world, they currently serve as an important means of communication, orientation and information source, and contribute to other daily functions. The International Telecommunication Union (ITU) (2013) survey, conducted in February 2013, reported 6.8 billion mobile subscriptions worldwide. Although most scientific and public attention on the safety of RF-EMR has focused on a potentially increased risk for brain tumours, a growing body of research points to another concern – sperm damage (La Vignera et al., 2012).

In the current literature, the effects of RF-EMR on semen parameters are inconclusive. This may be due, at least in part, to differences in study methodologies. While some studies assessed outcomes of in-vitro exposure of semen to radiation, other studies were observational (Agarwal et al., 2008, 2009; Erogul et al., 2006).

Men exposed to higher degrees of RF-EMR during their military service were found to be at higher risk (odds ratio (OR) = 1.86) of being infertile after 1 year (Baste et al., 2008). Another study found a higher rate of reduced semen quality after occupational exposure to electromagnetic fields (OR = 3.22) (Irgens et al., 1999). However, the above-mentioned studies did not sufficiently take into account the many possibly confounding factors such as lifestyle, demographic characteristics, aspects of device usage and occupational and health background.

Thus, the aim in the present study was to investigate possible associations between various aspects of cell phone usage (in addition to demographic and lifestyle parameters) and sperm quality, in light of the extremely high prevalence of cell phone usage in the Western world.

Materials and methods

This prospective study was approved by the local Institutional Review Board on 14 March 2011 (reference code: CMC-10–0087) and informed consent was obtained from all participants upon entering the study.

Study participants consisted of 106 male patients who underwent a first-time semen analysis as a part of infertility workup in the Fertility and IVF division of Carmel Medical Centre during 2011–2012. Each participant completed a detailed questionnaire before performing semen analysis. This included questions regarding their demographic background, i.e. age, place of living, number of children, occupation, ethnicity and educational status. There were also questions on their general medical history and fertility-related conditions (i.e. varicocele, orchitis), as well as lifestyle habits such as smoking and consumption of alcohol. Further questions accessed information about daily habits of cell phone usage such as the number of devices used and the duration of daily use (talking). The latter was classified by four categories: less than 30 min, 30–60 min, 60–120 min and over 120 min. The usual location of the device while talking, carrying and charging was assessed separately. The effect of RF-EMR is inversely proportional to the distance from the origin. As cited from the World Health Organization (WHO) (2015) website regarding electromagnetic fields: 'At a distance of 30 cm the magnetic fields surrounding most household appliances are more than 100 times lower than the given guideline limit of 100 μT at 50 Hz (83 μT at 60 Hz) for the general public'. Therefore, in this study, and in accordance with the work by Fejes *et al.* (Fejes et al., 2005), a conservative approach was adopted and a wider distance of 50 cm was chosen as a cutoff. Distance from the groin was classified by two categories: ≤50 cm or >50 cm.

Data regarding the use of accessories such as hands-free devices and earphones were collected as well. Other variables included the number of years that an individual owned a cell phone, talking while the device is being charged (as a categorical yes/no question) and talking in low reception areas (defined as: elevators and underground floors). Information on cell phone types, models and frequencies was not collected.

Exclusion criteria were: chronic or acute medical conditions that have been associated with a decrease in semen quality (e.g. long-standing diabetes mellitus, hypertension, varicocele, orchitis); smoking more than 10 pack years; and consumption of more than 1 litre of alcoholic beverages per day. After exclusion criteria were applied, smoking status was classified as 'ever smokers' for those who currently smoked or had smoked in the past (in both cases for less than 10 pack years) and 'never smokers' for those who had never smoked.

Semen quality was assessed using four parameters: volume, concentration, motility and morphology, according to the criteria of the World Health Organization, i.e. volume of ≥1.5 ml, concentration $\geq 15 \times 10^6$/ml, progressive motility ≥32% and ≥4% of normal forms. These are accepted normal values (World Health Organization, 2010).

Statistical analysis was performed using PASW statistics 18 (SPSS, Hong Kong). To examine associations between the categorical variables of the semen, a chi-squared test was applied. Correlation between continuous variables and the semen variables was examined with an independent *t*-test. To identify the factors that independently influence semen concentration, the variables that were statistically significant in univariate analysis were included in a multivariate logistic regression analysis. OR were calculated with 95% confidence interval (CI). A value of $P < 0.05$ was considered statistically significant.